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CEOS/17/Agency Reports:
IOCCG

**Item 19.6**

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# International Ocean Color Coordinating Group: Standardising the Extraterrestrial Solar Flux Spectrum used with Ocean-Colour Sensors

## SUMMARY AND PURPOSE

The purpose of this document is to encourage standardisation in the use of the spectrum of extraterrestrial solar irradiance for the average distance between the earth and sun, $\overline{F}_0(\lambda)$, by all Agencies that possess satellite ocean-colour sensors. Currently, Agencies make use of two different extraterrestrial solar flux spectra when processing their remotely-sensed ocean-colour data. Consequently, the products provided by the different Agencies are not fully comparable, nor compatible for merging processes. The incompatibility occurs for the top of the atmosphere radiances, as well as with "sea-truth" measurements of water-leaving radiances.

An ideal, but ambitious solution, would be the adoption of a standard extraterrestrial solar flux spectrum to be used in every aspect of research and validation in ocean-colour remote sensing. However, this would require significant changes in the software used for operational processing and validation analyses. An intermediate and convenient solution could be the following recommendation from IOCCG to all Agencies:

*Each Agency is requested to publish a detailed list of the* $\overline{F}_0(\lambda)$ *values employed, and more importantly, the results of the convolution of the adopted spectrum with the spectral shape of the actual channels, as implemented by their respective sensors.*

This information could be made available on the web sites of the various Agencies, as well as on the IOCCG site, if all Agencies agree to do so.

## ACTION PROPOSED

The 17th Plenary participants are invited to provide comments and advice.

**Standardising the Extraterrestrial Solar Flux Spectrum used with Ocean-Colour Sensors**

**Trevor Platt, Chairman IOCCG**

Various Agencies make use of two different extraterrestrial solar flux spectra when processing their remotely-sensed ocean-colour data. Historically, the mean extraterrestrial solar flux spectrum adopted was that of Neckel and Labs (1984). Recent determinations by Thuillier et al. (1998a,b), which appear more consistent with NIST traceable sources, differ from the previous spectrum by several percent, particularly in the blue part of the spectrum. Several Agencies have already adopted this new set of $\overline{F}_0(\lambda)$ values, at least for the shortest wavelengths. As a consequence, the products provided by the different Agencies are not fully comparable, nor compatible for merging processes. In summary, (see also Chapter 2 in Ocean Optics Protocols for Satellite Ocean Color Sensor Validation, Revision 4, Vol. 1, Mueller et al., 2003):

1- The incompatibility occurs for the "TOA" (top of the atmosphere) radiances, to the extent that they are in effect calibrated through the use of a reference illuminated by the sun (a diffusing plate, or the moon) and then expressed in absolute units by adopting an $\overline{F}_0(\lambda)$ spectrum.

2- This is also the case when dealing with "sea-truth" measurements of water-leaving radiances; when they are transformed into "normalised water-leaving radiances", the $\overline{F}_0(\lambda)$ values are once again involved.

3- This is not the case, however, when normalised leaving radiances, derived from several satellite sensors are compared. The $\overline{F}_0(\lambda)$ values (used twice) cancel out by the virtue of the normalisation.

Adopting a common international standard scale for $\overline{F}_0(\lambda)$ would be the best, albeit ambitious, solution. Pending such an ideal solution, an intermediate and expedient solution could be the following recommendation from IOCCG to all Agencies:

*Each Agency is requested to publish a detailed list of the $\overline{F}_0(\lambda)$ values employed, and more importantly, the results of the convolution of the adopted spectrum with the spectral shape of the actual channels, as implemented by their respective sensors.*

This information could be made available on the web sites of the various Agencies, as well as on the IOCCG site, if all Agencies agree to do so. This availability would allow the inter-conversion to be made, when needed, with a minimum of computational effort.

The IOCCG would like to encourage all Agencies to provide the necessary information, and also to make it publicly available on the internet.

**References**

Mueller, J.L., R.W. Austin., A. Morel, G.S. Fargion, and C.R. McClain, 2003. Ocean optics protocols for satellite ocean color sensor validation, Revision 4, Volume 1: Introduction, background and conventions. NASA/TM-2003-211621, Natioanl Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Maryland.

Neckel, H., and D. Labs, 1984: The solar radiation between 3300 and 12500 ? . Solar Phys., 205-258.

Thuillier, G., M. Herse, P.S. Simon, D. Labs, H. Mandel, D. Gillotay, and T. Foujols. 1998a: The visible solar spectral irradiance from 350 to 850 nm as measured by the SOLSPEC spectrometer during the Atlas 1 mission, Solar Phys. 177, 41-61.

Thuillier, G., M. Herse, P.S. Simon, D. Labs, H. Mandel, and D. Gillotay. 1998b: Observation of the solar spectral irradiance from 200 to 870 nm during Atlas 1 and Atlas 2 missions by the SOLSPEC spectrometer. Metrologia, 35, 689-695.